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10/532,978	04/28/2005	Toru Sano	Q87545	3025

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EXAMINER	
CHAN, CEDRIC A	

ART UNIT	PAPER NUMBER
1797	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/532,978	SANO ET AL.	
	Examiner	Art Unit	
	Cedric A. Chan	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 April 2005* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/28.05 & 10/03/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 15, 18 and 26 are objected to due to minor informalities. In claim 15, Examiner suggests Applicant include the word "for" in between "portions" and "capturing" (i.e., "portions, for capturing a specific component ...") in order to clarify that the limitation "capturing a specific component in said sample" is a functional limitation for describing the functionality of said plurality of capture portions. In claim 18, line 2, the word "channel" should be amended to read "channels." In claim 26, a transitional phrase such as "comprising" should be added after "Claims 21 to 25."

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claims 3, 4, 6, 13, 14-17, 19, 20, and 25** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 3 recites, "wherein said capture portion is formed ...with a small width." The phrase "with a small width" gives rise to uncertainty, because it implies that "a small width" is used in forming the capture portion. Any ambiguity in the claim may be resolved by simple re-tooling of the claim language and syntax.

In claim 4, the terms "the opening width" and "the center" lack sufficient antecedent basis. Where is this "opening width," located to with respect to the capture

portion and/or the channel? Which structural feature of the invention comprises "said opening width" – the separation apparatus (generally)? The capture portion? With further regard to claim 4, the Specification does not clearly define the meaning of the word "center," and so it is not possible to ascertain the scope of the invention as presently laid out. Is "the center" intended to refer literally to the geometric center of the channel, or is it meant to refer to the central axis of symmetry that runs along the length of the channel? Furthermore, it is not clear what "more distant" means in claim 4. The capture portion is "more distant" from the center, relative to what? What is the standard for determining these relative distances (Where is the distance measured from, etc.)?

Claim 6 recites "having an opening." It is unclear whether it is "said channel," or "the separation apparatus" that has said "opening."

Claim 13 recites the term "the residual portion," which lacks sufficient antecedent basis.

The terms, "the widened portions" and "[the] narrowed portions," recited in claim 14, lack antecedence because these portions are not recited in claim 1. Note, claim 13 refers to "expanded portions formed so as to have an expanded width...," but does not recite "narrowed portions." In addition, further structural clarification of the widened and narrowed portions is needed. With respect to which feature(s) of the claimed invention are the portions wider or narrower?

Claim 15 recites "a plurality of capture portions, capturing a specific component in said sample, formed in said partition wall beside each of said plurality of parallel channels." It is impossible to determine the precise structural relationship between the

partition and the plurality of capture portions, because the word "beside" has not been adequately defined.

As to claim 17, the term "said channel" is indefinite, because claim 17 is dependent on any one of claims 1, 13, or 15 and claim 15 recites a plurality of parallel channels. Correction/clarification is necessary.

In claim 25, it is unclear whether Applicants intend to claim a pocket portion (singular) or pocket portions (plural).

Appropriate corrections/clarification required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 1-5 and 9** are rejected under 35 U.S.C. 102(b) as being anticipated by Sano et al. (Preliminary Drafts of the 63rd Symposium of the Japan Society of Applied Physics, Japan, September 24, 2002, Volume Three, Pg. 1146, 25a-R-8.).

The publication of Sano et al. discussed herein has been disclosed by Applicant in the Information Disclosure Statement filed April 28, 2005 and cited by an Authorized Officer of the International Bureau of WIPO in the furnished International Preliminary Examination Report.

Sano et al. (hereinafter, "Sano") teach a separation device which functions according to a principle similar to that of size-exclusion chromatography, wherein the separation device comprises a patterned array chromatography (PAC) chip having a channel through which sample flows, said device separating biomolecules with high resolution using artificial nanostructured matter. The PAC chip comprises a combination of a nano-scale narrow space region (dense region) and a wide space region (sparse region). It is disclosed in the publication that the density structure is designed such that small molecules are trapped in a dense region while large molecules are arranged to flow only through wide regions without being trapped.

Sano teaches two embodiments of their device, along with the general method of fabrication of their device. In one embodiment, the separation device includes uniformly laid nano-size pillars which are formed by nano-lithographic methods (plus silicon dry etching). A plurality of pillars are formed using this well-known process technique. In another aspect, the device comprises a plurality of "hole" (i.e. concave "pocket") type elements formed on the surface of the channel wall (Fig. 1(c)) using a well-known anodized porous aluminum method. These embodiments are depicted in Fig. 1 of Sano's publication. Fig. 1 (b) shows a "stripe pattern" of silicon nano-pillars ("capture portions"), which make up the plurality of sample separation regions disposed on what is clearly a substrate/support (i.e., wall). Sano further discloses subjecting biomolecules (i.e., DNA) to electrophoresis by applying the aforementioned components.

It is noted that while the Publication of Sano discussed above does not explicitly suggest or provide teachings for the micro-machining techniques of their microfluidic

device (including wet/dry etching, silicon oxide deposition, etc.), such methods and techniques are indeed well known in the art. One could very reasonably assume that the device depicted in Fig. 1 could be (and most likely was) produced using such methods. More detailed discussions regarding these techniques are presented below.

5. **Claims 1-8, 10, 11-14, and 20** are rejected under 35 U.S.C. 102(b) as being anticipated by Bhullar et al. (US 6,319,719).

With respect to claims 1-4, Bhullar et al. (hereinafter, "Bhullar") teaches a capillary separation structure comprising a housing having a fluid inlet port, a reaction region, and a capillary pathway connecting the inlet port and the reaction region.

The separating device specifically includes a body (12) and a cover (14). A first end (16) includes an inlet port (18) for receiving a sample, e.g., whole blood. A reaction region (20) is spaced longitudinally from the inlet port and can be situated adjacent a second end (22). At least one channel (i.e., capillary pathway 24) has an inlet end (26) coupled to the inlet port 18, and an outlet end (28) coupled to the reaction region 20 (see Col. 3, lines 47-55). It is noted that the capillary pathway 24 may be referred to as a "groove," since it is formed as an elongated indentation using a resin, as will be discussed in greater detail below.

The capillary pathway (which is a 'sample separation region' in Bhullar's device) is provided with a plurality of obstructions (i.e., capture portions) for capturing or otherwise impeding movement of biological material through the capillary. Several possible shapes for the obstructions are shown in Figs. 3-5. Note Fig. 6E, which shows

an embodiment of Bhullar's invention wherein the obstructions are in the form of columnar pillars. The shape of the concave portions 32 can be smooth or not smooth. The capillary pathway itself can be a rectangular channel, but Bhullar emphasizes that the channel height and width do not have to be constant throughout the whole length and can even include steps (23) and/or ramps (25) that transition from one channel height or width to another, so that one end has greater height than the other (see Col. 3, lines 59-63; see also Col. 4, lines 7-40).

Fig. 2 shows an embodiment of Bhullar's invention wherein the downstream capture portions formed near reaction region 20 are larger than those formed upstream near inlet 18. In addition, one can clearly discern from Fig. 2 that the capillary pathway varies in width such that in an upstream portion (i.e., in the inlet area near inlet 18) the capillary pathway has greater width than it does in another region downstream of the inlet. Furthermore, following the narrowed portion just discussed, the capillary pathway comprises a plurality of 'expanded' portions having greater width than the narrowed portion immediately preceding them.

The separation device is made by micro-injection molding to form the capillary pathway 24 channel and obstructions 30 on a plastic resin substrate such as polycarbonate. After formation of the body 12, the device is hydrophilized and then covered with cover 14, which is affixed to the body by mechanical coupling or by solvent or ultrasonic bonding techniques. Note, while '719 highlights the formation of the capillary pathway by micro-injection molding, Bhullar states that the selection of the particular fabrication process is dependent upon the type of resin employed to

manufacture the apparatus. Bhullar goes on to cite "physical, such as plasma etching, or chemical, such as an application of DONS solution," processes as suitable alternatives to the one detailed in '719.

Bhullar also discloses a detection unit, comprising optical, electrical, or other quantitative evaluation/analysis means. Alternatively or in addition, the reaction region 20 can include an electrochemical apparatus for detection of an analyte in a sample such as blood (see Col. 5, lines 30-40).

The sample recovery unit of the instant invention is analogous to the reaction region 20 Bhullar discloses. After separation is completed, the purified sample drains in the reaction region, where it can be analyzed, for example, by analysis means as described previously.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al. or Bhullar et al. (US 6,319,719) as discussed above, in view of Gaoka et al. (WO 02/23180).

Please refer to the discussions above regarding the teachings of Sano and Bhullar. Neither Sano nor Bhullar teach a width-wise external force imposing unit.

Gaoka et al. (hereinafter, "Gaoka") teach an extractor for extracting a component in a liquid sample in which a projection (232) composed of a coupling member to couple with the component is provided in a passage of an extracting unit, and counter electrodes 230 and 231 are provided on side walls of the passage. An alternating electric field (external force) is applied to the counter electrodes, which causes the component to come contact and couple with the projection (see Abstract; see also Fig. 2). The positioning of the electrodes in Goaka's device implies that electrokinetic force is applied in the width-wise direction of the device.

It would have been obvious to one of ordinary skill in the art to provide the devices of Bhullar and/or Sano with the a width-wise electromotive force generator such as the one taught by Goaka, in order to induce molecular motion in that direction.

10. **Claim 18** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al. or Bhullar et al. (US 6,319,719) as discussed above, in view of Yager et al. (US 6,176,990) and Austin et al. (US 5,427,663).

Please refer to the discussions above regarding the teachings of Sano and Bhullar. Neither Sano nor Bhullar teach a plurality of channels.

Yager et al. (hereinafter, "Yager") teaches a microfabricated electrophoresis chip comprising a substrate in which there are formed one or more channels, one channel for each sample to be evaluated (see Abstract).

It would have been obvious to one of ordinary skill in the art to modify the inventions of either Sano or Bhullar to include a plurality of channels such as the device taught by Yager, in order to be able to process a greater number of (different) samples simultaneously.

Sano and Bhullar also do not teach an external force imposing unit imposing an external force to the sample in the longitudinal direction of the channels.

Austin et al. (hereinafter, "Austin") teaches various embodiments of a sorting apparatus, the sorting apparatus generally comprises an array of obstacles (39) which can be designed in an ordered, evenly spaced formation or a staggered formation wherein positioning of obstacles is un-uniform (see Col. 14, lines 20-45). In one

embodiment, the invention of Austin specifically comprises an external force imposing unit comprising electric force means for generating an electric field in the fluid medium in receptacle (24). The electric force drives molecular motion. Austin specifically discloses an embodiment wherein the power source (battery 44) is electrically coupled between first and second electrodes (40, 42) such that first electrode 40 and second electrode 42 provides electrokinetic energy in the longitudinal direction of Austin's device (see Fig. 2).

It would have been obvious to one of ordinary skill in the art to modify the teachings of Sano and/or Bhullar with that of Austin, in order to stimulate particulate motion within the fluid system by imposing electrokinetic forces across the apparatus.

11. **Claim 19** is rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al. (Preliminary Drafts of the 63rd Symposium of the Japan Society of Applied Physics, Japan, September 24, 2002, Volume Three, Pg. 1146, 25a-R-8.) or Bhullar et al. (US 6,319,719).

Please refer to the discussions above regarding the teachings of Sano and Bhullar.

Neither Sano nor Bhullar teach a sample introduction unit for introducing sample into the channel. However, persons of ordinary skill in the art are fully aware that there are a multitude of known fluid handling units. Such devices include syringes, capillary pipettes, automatic pipettes, burets, graduated cylinders, pump-valve systems, etc. Also, clearly neither Sano's nor Bhullar's devices would have any utility unless the users

of their inventions could introduce samples. The devices' reliance upon such sample introduction units is implicit in the teachings of their respective inventions.

It would have been obvious to any person of ordinary skill in the art to modify the devices of Sano and/or Bhullar with a well-known sample introduction unit, because the devices are only useful if samples can be delivered to them for processing.

12. **Claims 21, 22, 25, and 26** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al. (as previously discussed) in view of Christel et al. (US 7,135,144).

Sano teaches using a technique of forming anodized porous aluminum for producing the plurality of "pocket" capture portion elements in the device discussed previously. However, Sano does not explicitly disclose the step of depositing an oxide film on the surface of each pocket portion or column/pillar feature.

Christel et al. (hereinafter, "Christel") teach a fluid sample manipulation device, and a method of microfabricating such devices using various techniques, including deep reactive ion etching (DRIE). In one aspect, Christel's invention comprises a chamber on a chip having a densely packed array of columns etched into silicon using the DRIE method. Christel uses DRIE to etch a groove or channel into a silicon wafer substrate. After the fabrication process is over, Christel teaches that the silicon surfaces, including the columnar microstructures, may be coated with an insulator such as silicon oxide, silicon dioxide, etc. (see Col. 7, lines 25-60).

It would have been obvious to one of ordinary skill in the art to modify Sano's device by depositing an oxide film via oxidation of the feature (i.e., pocket / pillar) surfaces, in order to provide a degree of electrical insulation and to protect the substrate from the fluid.

Sano also does not teach providing a cover on the substrate.

Christel teaches bonding a (Pyrex) cover after fabrication using DRIE (See "Example 1" in Col. 11)

It would have been obvious to one of ordinary skill in the art to provide a cover to Sano's device in order to prevent fluid spillage or leakage out of the device.

13. **Claims 23 and 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al. in view of Yager et al. (US 6,176,990).

Sano teaches the separation apparatus discussed above, but Sano does not specifically disclose the method of fabrication recited in claims 23 and 24. However, the steps described in these claims are generally well known in the art.

Yager teaches a microelectrophoresis chip specifically fabricated using commonly known microfabrication techniques. Yager's chip device comprises a susbstrate with channels integrally disposed therein, said substrate being made of any of a number of materials, including silicon, polymeric materials, etc. A mold is used to form the separation matrix using lithography. A thin layer of a polymer resist (e.g., polymethylmethacrylate) is applied to a substrate (e.g. a resin substrate). The polymer resist is then softened by heating, and a mold is pressed against the softened resist and

an anisotropic etching process such as ion etching is used to remove the resist from the compressed areas (see Col. 6, lines 15-50).

It would have been obvious to one of ordinary skill in the art to perform the microfabrication techniques taught by Yager in fabricating the device of Sano, because it is a technique known for its ability to produce a highly accurate and effective final product.

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

15. **Claims 1-12, 14, and 17-19** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-28 of U.S. Patent No. 6,881,315. Although the conflicting claims are not identical, they are not

patentably distinct from each other because Patent '315 recites a region for permitting a sample to be migrated (which is structurally equivalent to the "channel" in the instant case), at least one colony of microbodies serving as obstacles (which is structurally equivalent to the "capture portion" in the instant case), and a labyrinth for trapping small microstructures (structurally equivalent to the "sample separation region" in the instant case). Aside from these minor differences in phraseology, there are no other material differences between the structure claimed in '315 and the structure of the instant invention (per claims 1-12, 14, and 17-19).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cedric A. Chan whose telephone number is (571) 270-3721. The examiner can normally be reached on Monday-Thursday 8:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C.C./

/Jill Warden/
Supervisory Patent Examiner, Art Unit 1797